Chapter 111. Texas Essential Knowledge and Skills for Mathematics

Subchapter A. Elementary

§111.2. Kindergarten, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)

(2) Number and operations. The student understands [applies mathematical process standards to understand] how to represent and compare whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system. The student is expected to:

(A)-(I) (No change.)

(3) Number and operations. The student develops [applies mathematical process standards to develop] an understanding of addition and subtraction situations in order to solve problems. The student is expected to:

(A)-(C) (No change.)

(4) Number and operations. The student identifies [applies mathematical process standards to identify] coins in order to recognize the need for monetary transactions. The student is expected to identify U.S. coins by name, including pennies, nickels, dimes, and quarters.

(5) Algebraic reasoning. The student identifies [applies mathematical process standards to identify] the pattern in the number word list. The student is expected to recite numbers up to at least 100 by ones and tens beginning with any given number.

(6) Geometry and measurement. The student analyzes [applies mathematical process standards to analyze] attributes of two-dimensional shapes and three-dimensional solids to develop generalizations about their properties. The student is expected to:

(A)-(F) (No change.)

(7) Geometry and measurement. The student directly compares [applies mathematical process standards to directly compare] measurable attributes. The student is expected to:

(A)-(B) (No change.)

(8) Data analysis. The student collects and organizes [applies mathematical process standards to collect and organize] data to make it useful for interpreting information. The student is expected to:

(A)-(C) (No change.)

(9) Personal financial literacy. The student manages [applies mathematical process standards to manage] one's financial resources effectively for lifetime financial security. The student is expected to:

(A)-(D) (No change.)

§111.3. Grade 1, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)
Number and operations. The student represents and compares whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system related to place value. The student is expected to:

(A)-(G) (No change.)

Number and operations. The student develops and uses strategies for whole number addition and subtraction computations in order to solve problems. The student is expected to:

(A)-(F) (No change.)

Number and operations. The student identifies coins, their values, and the relationships among them in order to recognize the need for monetary transactions. The student is expected to:

(A)-(C) (No change.)

Algebraic reasoning. The student identifies number patterns within properties of numbers and operations in order to describe relationships. The student is expected to:

(A)-(G) (No change.)

Geometry and measurement. The student analyzes attributes of two-dimensional shapes and three-dimensional solids to develop generalizations about their properties. The student is expected to:

(A)-(H) (No change.)

Geometry and measurement. The student selects and uses units to describe length and time. The student is expected to:

(A)-(E) (No change.)

Data analysis. The student organizes data to make it useful for interpreting information and solving problems. The student is expected to:

(A)-(C) (No change.)

Personal financial literacy. The student manages one's financial resources effectively for lifetime financial security. The student is expected to:

(A)-(D) (No change.)

§111.4. Grade 2, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)

(2) Number and operations. The student understands how to represent and compare whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system related to place value. The student is expected to:

(A)-(F) (No change.)

(3) Number and operations. The student recognizes and represents fractional units and communicates how they are used to name parts of a whole. The student is expected to:
(4) Number and operations. The student develops and uses strategies and methods for whole number computations in order to solve addition and subtraction problems with efficiency and accuracy. The student is expected to:

(A)-(D) (No change.)

(5) Number and operations. The student determines the value of coins in order to solve monetary transactions. The student is expected to:

(A)-(B) (No change.)

(6) Number and operations. The student connects repeated addition and subtraction to multiplication and division situations that involve equal groupings and shares. The student is expected to:

(A)-(B) (No change.)

(7) Algebraic reasoning. The student identifies and applies number patterns within properties of numbers and operations in order to describe relationships. The student is expected to:

(A)-(C) (No change.)

(8) Geometry and measurement. The student analyzes attributes of two-dimensional shapes and three-dimensional solids to develop generalizations about their properties. The student is expected to:

(A)-(E) (No change.)

(9) Geometry and measurement. The student selects and uses units to describe length, area, and time. The student is expected to:

(A)-(G) (No change.)

(10) Data analysis. The student organizes data to make it useful for interpreting information and solving problems. The student is expected to:

(A)-(D) (No change.)

(11) Personal financial literacy. The student manages one's financial resources effectively for lifetime financial security. The student is expected to:

(A)-(F) (No change.)

§111.5. Grade 3, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)

(2) Number and operations. The student represents and compares whole numbers and understand relationships related to place value. The student is expected to:

(A)-(D) (No change.)

(3) Number and operations. The student represents and explains fractional units. The student is expected to:

(A)-(H) (No change.)
(4) Number and operations. The student develops and uses [applies mathematical process standards to develop and use] strategies and methods for whole number computations in order to solve problems with efficiency and accuracy. The student is expected to:

(A)-(K) (No change.)

(5) Algebraic reasoning. The student analyzes and creates [applies mathematical process standards to analyze and create] patterns and relationships. The student is expected to:

(A)-(E) (No change.)

(6) Geometry and measurement. The student analyzes [applies mathematical process standards to analyze] attributes of two-dimensional geometric figures to develop generalizations about their properties. The student is expected to:

(A)-(E) (No change.)

(7) Geometry and measurement. The student selects [applies mathematical process standards to select] appropriate units, strategies, and tools to solve problems involving customary and metric measurement. The student is expected to:

(A)-(E) (No change.)

(8) Data analysis. The student solves [applies mathematical process standards to solve] problems by collecting, organizing, displaying, and interpreting data. The student is expected to:

(A)-(B) (No change.)

(9) Personal financial literacy. The student manages [applies mathematical process standards to manage] one's financial resources effectively for lifetime financial security. The student is expected to:

(A)-(F) (No change.)

§111.6. Grade 4, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)

(2) Number and operations. The student represents, compares, and orders [applies mathematical process standards to represent, compare, and order] whole numbers and decimals and understand relationships related to place value. The student is expected to:

(A)-(H) (No change.)

(3) Number and operations. The student represents and generates [applies mathematical process standards to represent and generate] fractions to solve problems. The student is expected to:

(A)-(G) (No change.)

(4) Number and operations. The student develops and uses [applies mathematical process standards to develop and use] strategies and methods for whole number computations and decimal sums and differences in order to solve problems with efficiency and accuracy. The student is expected to:

(A)-(H) (No change.)

(5) Algebraic reasoning. The student develops [applies mathematical process standards to develop] concepts of expressions and equations. The student is expected to:

(A)-(D) (No change.)

(6) Geometry and measurement. The student analyzes [applies mathematical process standards to analyze] geometric attributes in order to develop generalizations about their properties. The student is expected to:
(A)-(D) (No change.)

(7) Geometry and measurement. The student solves problems involving angles less than or equal to 180 degrees. The student is expected to:
(A)-(E) (No change.)

(8) Geometry and measurement. The student selects appropriate customary and metric units, strategies, and tools to solve problems involving measurement. The student is expected to:
(A)-(C) (No change.)

(9) Data analysis. The student solves problems by collecting, organizing, displaying, and interpreting data. The student is expected to:
(A)-(B) (No change.)

(10) Personal financial literacy. The student manages one's financial resources effectively for lifetime financial security. The student is expected to:
(A)-(E) (No change.)

§111.7. Grade 5, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)

(2) Number and operations. The student represents, compares, and orders positive rational numbers and understand relationships as related to place value. The student is expected to:
(A)-(C) (No change.)

(3) Number and operations. The student develops and uses strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:
(A)-(L) (No change.)

(4) Algebraic reasoning. The student develops concepts of expressions and equations. The student is expected to:
(A)-(H) (No change.)

(5) Geometry and measurement. The student classifies two-dimensional figures by attributes and properties. The student is expected to classify two-dimensional figures in a hierarchy of sets and subsets using graphic organizers based on their attributes and properties.

(6) Geometry and measurement. The student understands, recognizes, and quantifies volume. The student is expected to:
(A)-(B) (No change.)

(7) Geometry and measurement. The student selects appropriate units, strategies, and tools to solve problems involving measurement. The student is expected to solve problems by calculating conversions within a measurement system, customary or metric.
(8) Geometry and measurement. The student identifies locations on a coordinate plane. The student is expected to:

(A)-(C) (No change.)

(9) Data analysis. The student solves problems by collecting, organizing, displaying, and interpreting data. The student is expected to:

(A)-(C) (No change.)

(10) Personal financial literacy. The student manages one's financial resources effectively for lifetime financial security. The student is expected to:

(A)-(F) (No change.)
Subchapter B. Middle School


(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)

(2) Number and operations. The student represents and uses rational numbers in a variety of forms. The student is expected to:

(A)-(E) (No change.)

(3) Number and operations. The student represents addition, subtraction, multiplication, and division while solving problems and justifying solutions. The student is expected to:

(A)-(E) (No change.)

(4) Proportionality. The student develops an understanding of proportional relationships in problem situations. The student is expected to:

(A)-(H) (No change.)

(5) Proportionality. The student solves problems involving proportional relationships. The student is expected to:

(A)-(C) (No change.)

(6) Expressions, equations, and relationships. The student uses multiple representations to describe algebraic relationships. The student is expected to:

(A)-(C) (No change.)

(7) Expressions, equations, and relationships. The student develops concepts of expressions and equations. The student is expected to:

(A)-(D) (No change.)

(8) Expressions, equations, and relationships. The student uses geometry to represent relationships and solve problems. The student is expected to:

(A)-(D) (No change.)

(9) Expressions, equations, and relationships. The student uses equations and inequalities to represent situations. The student is expected to:

(A)-(C) (No change.)

(10) Expressions, equations, and relationships. The student uses equations and inequalities to solve problems. The student is expected to:

(A)-(B) (No change.)

(11) Measurement and data. The student uses coordinate geometry to identify locations on a plane. The student is expected to graph points in all four quadrants using ordered pairs of rational numbers.

(12) Measurement and data. The student uses numerical or graphical representations to analyze problems. The student is expected to:

(A)-(D) (No change.)
(13) Measurement and data. The student uses numerical or graphical representations to solve problems. The student is expected to:
   (A)-(B) (No change.)

(14) Personal financial literacy. The student develops an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:
   (A)-(H) (No change.)

§111.27. Grade 7, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.
   (1) (No change.)
   (2) Number and operations. The student represents and uses rational numbers in a variety of forms. The student is expected to extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of rational numbers.
   (A)-(B) (No change.)
   (3) Number and operations. The student adds, subtracts, multiplies, and divides while solving problems and justifying solutions. The student is expected to:
   (A)-(B) (No change.)
   (4) Proportionality. The student represents and solves problems involving proportional relationships. The student is expected to:
   (A)-(E) (No change.)
   (5) Proportionality. The student uses geometry to describe or solve problems involving proportional relationships. The student is expected to:
   (A)-(C) (No change.)
   (6) Proportionality. The student uses probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:
   (A)-(I) (No change.)
   (7) Expressions, equations, and relationships. The student represents linear relationships using multiple representations. The student is expected to represent linear relationships using verbal descriptions, tables, graphs, and equations that simplify to the form $y = mx + b$.
   (A)-(C) (No change.)
   (8) Expressions, equations, and relationships. The student develops geometric relationships with volume. The student is expected to:
   (A)-(C) (No change.)
   (9) Expressions, equations, and relationships. The student solves geometric problems. The student is expected to:
   (A)-(D) (No change.)
   (10) Expressions, equations, and relationships. The student uses one-variable equations and inequalities to represent situations. The student is expected to:
   (A)-(C) (No change.)
Expressions, equations, and relationships. The student solves one-variable equations and inequalities. The student is expected to:

(A)-(C) (No change.)

Measurement and data. The student uses statistical representations to analyze data. The student is expected to:

(A)-(C) (No change.)

Personal financial literacy. The student develops an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

(A)-(F) (No change.)

§111.28. Grade 8, Adopted 2012.

(a) (No change.)

(b) Knowledge and skills.

(1) (No change.)

(2) Number and operations. The student represents and uses real numbers in a variety of forms. The student is expected to:

(A)-(D) (No change.)

(3) Proportionality. The student uses proportional relationships to describe dilations. The student is expected to:

(A)-(C) (No change.)

(4) Proportionality. The student explains proportional and non-proportional relationships involving slope. The student is expected to:

(A)-(C) (No change.)

(5) Proportionality. The student uses proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:

(A)-(I) (No change.)

(6) Expressions, equations, and relationships. The student develops mathematical relationships and makes connections to geometric formulas. The student is expected to:

(A)-(C) (No change.)

(7) Expressions, equations, and relationships. The student uses geometry to solve problems. The student is expected to:

(A)-(D) (No change.)

(8) Expressions, equations, and relationships. The student uses one-variable equations or inequalities in problem situations. The student is expected to:

(A)-(D) (No change.)

(9) Expressions, equations, and relationships. The student uses multiple representations to develop foundational concepts of simultaneous linear equations. The student is expected to identify and verify the values of x and y that simultaneously satisfy two linear equations in the form $y = mx + b$ from the intersections of the graphed equations.
(10) Two-dimensional shapes. The student develops transformational geometry concepts. The student is expected to:
(A)-(D) (No change.)

(11) Measurement and data. The student uses statistical procedures to describe data. The student is expected to:
(A)-(C) (No change.)

(12) Personal financial literacy. The student develops an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:
(A)-(G) (No change.)
Subchapter C. High School

§111.39. Algebra I, Adopted 2012 (One Credit).

(a)-(b) (No change.)

(c) Knowledge and skills.

(1) (No change.)

(2) Linear functions, equations, and inequalities. The student uses properties of linear functions to write and represent in multiple ways, with and without technology, linear equations, inequalities, and systems of equations. The student is expected to:

   (A)-(I) (No change.)

(3) Linear functions, equations, and inequalities. The student uses graphs of linear functions, key features, and related transformations to represent in multiple ways and solve, with and without technology, equations, inequalities, and systems of equations. The student is expected to:

   (A)-(H) (No change.)

(4) Linear functions, equations, and inequalities. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

   (A)-(C) (No change.)

(5) Linear functions, equations, and inequalities. The student solves , with and without technology, linear equations and evaluates the reasonableness of their solutions. The student is expected to:

   (A)-(C) (No change.)

(6) Quadratic functions and equations. The student uses properties of quadratic functions to write and represent in multiple ways, with and without technology, quadratic equations. The student is expected to:

   (A)-(C) (No change.)

(7) Quadratic functions and equations. The student uses graphs of quadratic functions and their related transformations to represent in multiple ways and determine, with and without technology, the solutions to equations. The student is expected to:

   (A)-(C) (No change.)

(8) Quadratic functions and equations. The student solves , with and without technology, quadratic equations and evaluates the reasonableness of his or her solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

   (A)-(B) (No change.)

(9) Exponential functions and equations. The student uses properties of exponential functions and their related transformations to write, graph, and represent in multiple ways exponential equations and evaluates, with and without technology, the reasonableness of his or her solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

   (A)-(E) (No change.)
(10) Number and algebraic methods. The student applies [the mathematical process standards and] algebraic methods to rewrite in equivalent forms and perform operations on polynomial expressions. The student is expected to:

(A)-(F) (No change.)

(11) Number and algebraic methods. The student applies [the mathematical process standards and] algebraic methods to rewrite algebraic expressions into equivalent forms. The student is expected to:

(A)-(B) (No change.)

(12) Number and algebraic methods. The student applies [the mathematical process standards and] algebraic methods to write, solve, analyze, and evaluate equations, relations, and functions. The student is expected to:

(A)-(E) (No change.)

§111.40. Algebra II, Adopted 2012 (One-Half to One Credit).

(a)-(b) (No change.)

(c) Knowledge and skills.

(1) (No change.)

(2) Attributes of functions and their inverses. The student understands [applies mathematical processes to understand] that functions have distinct key attributes and understands [understand] the relationship between a function and its inverse. The student is expected to:

(A)-(D) (No change.)

(3) Systems of equations and inequalities. The student formulates [applies mathematical processes to formulate] systems of equations and inequalities, uses [use] a variety of methods to solve, and analyzes [analyze] reasonableness of solutions. The student is expected to:

(A)-(G) (No change.)

(4) Quadratic and square root functions, equations, and inequalities. The student understands [applies mathematical processes to understand] that quadratic and square root functions, equations, and quadratic inequalities can be used to model situations, solve problems, and make predictions. The student is expected to:

(A)-(H) (No change.)

(5) Exponential and logarithmic functions and equations. The student understands [applies mathematical processes to understand] that exponential and logarithmic functions can be used to model situations and solve problems. The student is expected to:

(A)-(E) (No change.)

(6) Cubic, cube root, absolute value and rational functions, equations, and inequalities. The student understands [applies mathematical processes to understand] that cubic, cube root, absolute value and rational functions, equations, and inequalities can be used to model situations, solve problems, and make predictions. The student is expected to:

(A)-(L) (No change.)

(7) Number and algebraic methods. The student simplifies and performs [applies mathematical processes to simplify and perform] operations on expressions and solves [to solve] equations. The student is expected to:

(A)-(I) (No change.)
Data. The student analyzes appropriate models, writes corresponding functions, and makes predictions. The student is expected to:

(A)-(C) (No change.)

§111.41. Geometry, Adopted 2012 (One Credit).

(a)-(b) (No change.)

(c) Knowledge and skills.

(1) (No change.)

(2) Coordinate and transformational geometry. The student understands the connections between algebra and geometry and uses the one- and two-dimensional coordinate systems to verify geometric conjectures. The student is expected to:

(A)-(C) (No change.)

(3) Coordinate and transformational geometry. The student generates and describes rigid transformations (translation, reflection, and rotation) and non-rigid transformations (dilations that preserve similarity and reductions and enlargements that do not preserve similarity). The student is expected to:

(A)-(D) (No change.)

(4) Logical argument and constructions. The student uses deductive reasoning to understand geometric relationships. The student is expected to:

(A)-(D) (No change.)

(5) (No change.)

(6) Proof and congruence. The student uses deductive reasoning to prove and apply theorems by using a variety of methods such as coordinate, transformational, and axiomatic and formats such as two-column, paragraph, and flow chart. The student is expected to:

(A)-(E) (No change.)

(7) Similarity, proof, and trigonometry. The student applies similarity to solve problems. The student is expected to:

(A)-(B) (No change.)

(8) Similarity, proof, and trigonometry. The student uses deductive reasoning to prove and apply theorems by using a variety of methods such as coordinate, transformational, and axiomatic and formats such as two-column, paragraph, and flow chart. The student is expected to:

(A)-(B) (No change.)

(9) Similarity, proof, and trigonometry. The student understands and applies relationships in right triangles. The student is expected to:

(A)-(B) (No change.)

(10) Two-dimensional and three-dimensional figures. The student recognizes characteristics and dimensional changes of two- and three-dimensional figures. The student is expected to:

(A)-(B) (No change.)
(11) Two-dimensional and three-dimensional figures. The student applies formulas to determine measures of two- and three-dimensional figures. The student is expected to:
(A)-(D) (No change.)

(12) Circles. The student understands geometric relationships and applies theorems and equations about circles. The student is expected to:
(A)-(E) (No change.)

(13) Probability. The student understands probability in real-world situations and how to apply independence and dependence of events. The student is expected to:
(A)-(E) (No change.)

§111.42. Precalculus, Adopted 2012 (One-Half to One Credit).
(a)-(b) (No change.)
(c) Knowledge and skills.
(1) (No change.)
(2) Functions. The student explores, describes, and analyzes the attributes of functions. The student makes connections between multiple representations of functions and algebraically constructs new functions. The student analyzes and uses functions to model real-world problems. The student is expected to:
(A)-(P) (No change.)
(3) Relations and geometric reasoning. The student models and makes connections between algebraic and geometric relations. The student is expected to:
(A)-(I) (No change.)
(4) Number and measure. The student applies appropriate techniques, tools, and formulas to calculate measures in mathematical and real-world problems. The student is expected to:
(A)-(K) (No change.)
(5) Algebraic reasoning. The student evaluates expressions, describes patterns, formulates models, and solves equations and inequalities using properties, procedures, or algorithms. The student is expected to:
(A)-(N) (No change.)

§111.43. Mathematical Models with Applications, Adopted 2012 (One Credit).
(a)-(b) (No change.)
(c) Knowledge and skills.
(1) (No change.)
(2) Mathematical modeling in personal finance. The student uses graphical and numerical techniques to study patterns and analyze data related to personal finance. The student is expected to:
(A)-(C) (No change.)
Mathematical modeling in personal finance. The student uses algebraic formulas, graphs, and amortization modeling to solve problems involving credit. The student is expected to:

(A)-(D) (No change.)

Mathematical modeling in personal finance. The student uses algebraic formulas, numerical techniques, and graphs to solve problems related to financial planning. The student is expected to:

(A)-(C) (No change.)

Mathematical modeling in science and engineering. The student applies algebraic techniques to study patterns and analyze data as it applies to science. The student is expected to:

(A)-(C) (No change.)

Mathematical modeling in science and engineering. The student applies algebra and geometry to study patterns and analyze data as it applies to architecture and engineering. The student is expected to:

(A)-(D) (No change.)

Mathematical modeling in fine arts. The student uses algebra and geometry to study patterns and analyze data as it applies to fine arts. The student is expected to:

(A)-(D) (No change.)

Mathematical modeling in social sciences. The student determines the number of elements in a finite sample space and compute the probability of an event. The student is expected to:

(A)-(C) (No change.)

Mathematical modeling in social sciences. The student applies mathematical models to analyze data as it applies to social sciences. The student is expected to:

(A)-(F) (No change.)

Mathematical modeling in social sciences. The student designs a study and uses graphical, numerical, and analytical techniques to communicate the results of the study. The student is expected to:

(A)-(B) (No change.)

§111.44. Advanced Quantitative Reasoning, Adopted 2012 (One-Half to One Credit).

(a)-(b) (No change.)

(c) Knowledge and skills.

(1) (No change.)

(2) Numeric reasoning. The student generates new understandings by extending existing knowledge. The student generates new mathematical understandings through problems involving numerical data that arise in everyday life, society, and the workplace. The student extends existing knowledge and skills to analyze real-world situations. The student is expected to:

(A)-(H) (No change.)

(3) Algebraic reasoning (expressions, equations, and generalized relationships). The student creates and analyzes mathematical models of everyday situations to make informed decisions related to earning, investing, spending, and borrowing money by appropriate, proficient, and efficient use of tools, including technology.
The student uses mathematical relationships to make connections and predictions. The student judges the validity of a prediction and uses mathematical models to represent, analyze, and solve dynamic real-world problems. The student is expected to:

(A)-(H) (No change.)

(4) Probabilistic and statistical reasoning. The student generates [uses the process standards in mathematics to generate] new understandings of probability and statistics. The student analyzes statistical information and evaluates risk and return to connect mathematical ideas and make informed decisions. The student applies a problem-solving model and statistical methods to design and conduct a study that addresses one or more particular question(s). The student uses multiple representations to communicate effectively the results of student-generated statistical studies and the critical analysis of published statistical studies. The student is expected to:

(A)-(T) (No change.)

§111.47. Statistics, Adopted 2015 (One Credit).

(a)-(b) (No change.)

(c) Knowledge and skills.

(1) (No change.)

(2) Statistical process sampling and experimentation. The student applies [mathematical processes to apply] understandings about statistical studies, surveys, and experiments to design and conduct a study and uses [use] graphical, numerical, and analytical techniques to communicate the results of the study. The student is expected to:

(A)-(G) (No change.)

(3) Variability. The student describes and models [applies the mathematical process standards when describing and modeling] variability. The student is expected to:

(A)-(D) (No change.)

(4) Categorical and quantitative data. The student represents and analyzes [applies the mathematical process standards to represent and analyze] both categorical and quantitative data. The student is expected to:

(A)-(F) (No change.)

(5) Probability and random variables. The student connects [applies the mathematical process standards to connect] probability and statistics. The student is expected to:

(A)-(D) (No change.)

(6) Inference. The student makes [applies the mathematical process standards to make] inferences and justifies [justify] conclusions from statistical studies. The student is expected to:

(A)-(J) (No change.)

(7) Bivariate data. The student analyzes [applies the mathematical process standards to analyze] relationships among bivariate quantitative data. The student is expected to:

(A)-(F) (No change.)

§111.48. Algebraic Reasoning, Adopted 2015 (One Credit).

(a)-(b) (No change.)

(c) Knowledge and skills.

(1) (No change.)
(2) Patterns and structure. The student connects finite differences or common ratios to attributes of functions. The student is expected to:

(A)–(D) (No change.)

(3) Patterns and structure. The student understands the connections among representations of functions and combinations of functions, including the constant function, \( f(x) = x \), \( f(x) = x^2 \), \( f(x) = \sqrt{x} \), \( f(x) = \frac{1}{x} \), \( f(x) = x^3 \), \( f(x) = b^x \), \( f(x) = |x| \), and \( f(x) = \log_b(x) \) where \( b \) is 10 or \( e \); functions and their inverses; and key attributes of these functions. The student is expected to:

(A)–(F) (No change.)

(4) Number and algebraic methods. The student simplifies and performs operations on functions represented in a variety of ways, including real-world situations. The student is expected to:

(A)–(D) (No change.)

(5) Number and algebraic methods. The student represents, simplifies, and performs operations on matrices and solves systems of equations using matrices. The student is expected to:

(A)–(E) (No change.)

(6) Number and algebraic methods. The student estimates and determines solutions to equations resulting from functions and real-world applications with fluency. The student is expected to:

(A)–(C) (No change.)

(7) Modeling from data. The student analyzes and models data based on real-world situations with corresponding functions. The student is expected to:

(A)–(E) (No change.)